

PATENT ABSTRACTS OF JAPAN

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(54) **PROGRAMMING SYSTEM OF MICROCOMPUTER**

(57)Abstract:

PURPOSE: To execute a program even if part of the memory of a microcontroller becomes defective by rearranging plural programs and data on the memory.

CONSTITUTION: The memory consists of a ROM 2 stored with the programs and fixed data and a RAM 3 stored with other data. The programs are multi- arranged on the memory (in triple arrangement). Namely the initial diagnostic routine 10 which performs various initial setting processes and checks the operations of the ROM 2 and RAM 3 and the programs A11A'12 and A"13 as actual programs are stored in the area of the ROM 2. The programs A11A'12 and A"13 are programs for the same process and the fixed data are included therein. In the area of the RAM 3 data 20 for the execution of the programs A11A'12 and A"13 are stored.

CLAIMS

[Claim(s)]

[Claim 1] A memory which stores a program and data.

CPU and a peripheral-control circuit which execute a program.

It is a programming method of a microcontroller provided with the above and multiplex arrangement of said program is carried out on said memory.

[Claim 2] A memory which stores a program and data.

CPU and a peripheral-control circuit which execute a program.

It is the programming method provided with the above and multiplex arrangement of said program and said data is carried out on said memory.

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Industrial Application] This invention relates to the programming method of a

microcontroller.

[0002]

[Description of the Prior Art]The conventional programming method arranged a program and data to the beforehand fixed single field on a memory.

[0003]

[Problem(s) to be Solved by the Invention]However in this conventional programming method in order to arrange a program and data to the beforehand fixed single field on a memory when a defect arose in the memory equivalent to that field there was a problem that execution of a program became impossible.

[0004]The technical SUBJECT of this invention is providing the programming method of the microcontroller which can execute a program even if a defect arises in a part of memory of a microcontroller in view of the above-mentioned fault.

[0005]

[Means for Solving the Problem]In a programming method of a microcontroller which has a memory which stores a program and data CPU which executes a program and a peripheral-control circuit according to this invention Multiplex arrangement of said program is carried out on said memory and a programming method of a microcontroller characterized by things is obtained.

[0006]In a programming method of a microcontroller which has a memory which stores a program and data CPU which executes a program and a peripheral-control circuit according to this invention Multiplex arrangement of said program and said data is carried out on said memory and a programming method characterized by things is obtained.

[0007]That is a programming method of this invention carries out multiplex arrangement of a program or a program and the data on a memory.

[0008]

[Example]Next the example of this invention is described with reference to drawings.

[0009]Drawing 1 is a block diagram of the microcontroller 100 of one example of this invention. The peripheral-control circuits 4 are a timer and an I/O controller etc. A memory comprises ROM2 which has stored a program and fixed data and RAM3 which store data in addition to this. CPU1 executes a program with reference to ROM2 and RAM3 controlling the peripheral-control circuit 4.

[0010]Drawing 2 shows the example of a memory map at the time of carrying out multiplex arrangement of the program (3-fold arrangement). The program A11 and the program A'12 which are the initial diagnostic routine 10 which performs the operation check of various initialization processings and ROM2 and RAM3 and a actual program and program A"13 are stored in the field of ROM2. The program A11 the program A'12 and program A"13 are the programs of the same processing and also contain fixed data in it. In performing the program A11 the program A'12 and program A"13 the field of RAM3 stores the data 20.

[0011]Drawing 3 is an example of a flow chart of processing of drawing 2. With the initial diagnostic routine 10 the operation check of ROM2 is performed (Step S1) and if the field of the program A11 is normal the program A11 will be executed (Step S2). If ROM2 of the field of the program A11 is not normal the field of the program A'12 will be judged (Step S3) and if normal the program A'12 will be executed (step S4). Similarly if ROM2 of the field of the program A'12 is not normal it will judge about the field of program A"13 (Step S5) if normal program A"13 will be performed (Step S6) and error

handling will be performed if not normal (Step S7).

[0012] Usually the operation check of the ROM area writes checksum data in the object domain beforehand and judges whether it is normal by the result of an operation so that all the field data may be calculated (exclusive OR or addition) and it may be set to 0.

[0013] Drawing 4 shows the example of a memory map at the time of carrying out multiplex arrangement (3-fold arrangement) of a program and the data.

[0014] RAM3 is divided into the data A21 the data A'22 and the data A"23 and it uses it respectively as a field which stores the program A11 the program A'12 and the data of program A"13. Except it it is the same as that of drawing 2.

[0015] Drawing 5 is an example of a flow chart of processing of drawing 4.

In addition to the operation check of ROM2 the operation check of RAM3 is also carried out simultaneously and performs the program A11 with each normal field where ROM2 and RAM3 correspond A'12 and A"13.

Except it it is the same as that of drawing 3.

[0016] Namely with the initial diagnostic routine 10 perform the operation check of ROM2 (Step S11) and if the field of the program A11 is normal the operation check of RAM3 is performed (Step S12) and if the field of the data A21 is normal the program A11 will be executed (Step S13). If ROM2 of the field of the program A11 is not normal the field of the program A'12 will be judged (Step S14) if normal the field of the data A'22 will be judged (Step S15) and if normal the program A'12 will be executed (Step S16).

[0017] Similarly if ROM2 of the field of the program A'12 is not normal will judge about the field of program A"13 (Step S17) and if normal the field of the data A"23 is judged (Step S18) if normal program A"13 will be performed (Step S19) and error handling will be performed if not normal (Step S20).

[0018] The check of a RAM area reads by writing in data and is usually performed by comparing the contents of data.

[0019]

[Effect of the Invention] As explained above since this invention carried out multiplex arrangement of a program or a program and the data on the memory even if a defect arises in a part of memory it has the result that execution of a program is attained.

[0020] In particular the memory of a microcontroller has large-scale-sized and the programming method of this invention is effective now.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] It is a block diagram of the microcontroller of one example of this invention.

[Drawing 2] It is an example of a memory map in the case of having arranged the program three-fold by drawing 1.

[Drawing 3] It is an example of a flow chart in the case of having arranged the program three-fold by drawing 1.

[Drawing 4] It is an example of a memory map in the case of having arranged a program and three-fold data by drawing 1.

[Drawing 5] It is an example of a flow chart in the case of having arranged a program and three-fold data by drawing 1.

[Description of Notations]

100 Microcontroller

1 CPU

2 ROM

3 RAM

10 Initial diagnostic routine

11 Program A

12 Program A'

13 Program A''

20 Data

21 Data A

22 Data A'

23 Data A''

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